Diet quality: associations with health messages included in the Danish Dietary Guidelines 2005, personal attitudes and social factors

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Abstract

Objective: To study the association between diet quality and the new health messages in the Danish Dietary Guidelines 2005, i.e. 'Eat a varied diet', 'Engage in regular physical activity' and 'Maintain a healthy body weight'.

Design/setting/subjects: The study was cross-sectional, comprising a random sample of 3151 Danish adults aged 18–75 years. Dietary intake was estimated using a 7 d pre-coded food diary. Information on social background, leisure-time physical activity, height, body weight and intention to eat healthily was obtained by in-person interviews. Logistic regression models were used to explore the independent effects of energy intake, leisure-time physical activity, food variety, BMI, age, gender, education, household income, location of residence and intention to eat healthily on the likelihood to have high diet quality measured by an index based on the intake of dietary fibre and saturated fat.

Results: Greater food variety (OR = 1·32 for women, 1·13 for men), high leisure-time physical activity (OR = 2·20 for women, 1·91 for men), frequent intentions to eat healthily (OR = 8·19 for women, 5·40 for men) and low energy intake (OR = 0·78 for women, 0·85 for men) were significantly associated with high diet quality. For women education was positively associated with diet quality. The study did not demonstrate any association between BMI and diet quality.

Conclusion: The health behaviours 'Eat a varied diet' and 'Engage in regular physical activity' were positively associated with healthy eating. The dietary habits reported were strongly influenced by personal intentions. Thus, the biggest challenge for public health nutritionists will be to reach non-compliers who seldom have intentions to eat healthily.

Dietary guidelines are an instrument to coordinate health messages that relate to diet and lifestyle. As with the Dietary Guidelines for Americans[1], the Danish Dietary Guidelines (DDG) 2005 now extend to other lifestyle recommendations that impact on nutrition and health[2]. Like in other countries, in Denmark dietary guidelines have existed for a long time, with the first official DDG appearing in 1975. The latest version was published in 2005 and now includes five dietary recommendations and three new health messages: 'Eat a varied diet', 'Maintain a healthy body weight' and 'Engage in regular physical activity'[2].

The recommendation 'Eat a varied diet' was included in the first DDG from 1975, and omitted in the 1995 version, but is again part of the DDG 2005. There has been some concern that increased food variety is followed by increased energy intake, as has been found in several studies[3,4]. In this way, the recommendation 'Eat a varied

diet' may work against maintaining a healthy body weight. However, a combination of a high intake from the basic food groups and dietary variety increases the probability of covering nutritional needs, and dietary variety within a food group minimises the risk of contamination, e.g. methylmercury from fish. Therefore the message was reintroduced; this time together with the message 'Maintain a healthy body weight' to signal that increased variety and intake in general should be limited to meet energy needs. Furthermore, the intake of food and beverages should be seen in relation to daily physical activity level, which is one of the reasons for introducing physical activity in the DDG 2005[2].

The DDG 2005 also aims at preventing weight gain leading to overweight and obesity. Therefore, physical activity is included for the first time in the DDG 2005, although official recommendations concerning physical

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activity have been present in Denmark since 1989. A further reason for including physical activity in the DDG is that a healthy diet and regular physical activity prevent the same lifestyle diseases, and in combination have a greater effect than diet or physical activity alone[5]. In addition, a positive association between intake of fruits and vegetables and physical activity level during leisure time has been identified for both men and women[6,7]. Together, this underlines that diet and physical activity should be combined in guidelines as these behaviours are not alternatives, but both components of a healthy lifestyle that have additive effects on health when used in combination.

Since social factors, personal intentions and attitudes may have a strong influence on dietary behaviour, and thus diet quality, it is important to include these factors when analysing associations between diet quality and other health behaviours. Several studies have shown social differences in food habits[8–10]. Analysis of the Danish Dietary Survey 1995 showed that education is the social factor with the strongest association with intakes of fruits and vegetables and total fat. The longer the education, the higher the intake of fruits and vegetables and the lower the intake of fat. In that study attitudes and behaviour were closely associated, as persons with high intention to eat healthily also practised eating a more healthy diet[10].

In a Norwegian study the intention to eat healthily had the strongest and most consistent positive association with diet quality, in both men and women, compared with social determinants such as education, socio-economic status and location of residence[8]. These results indicate that it is important to include personal intentions when analysing associations between diet quality and social factors.

In a recent Danish study it was found that a Simple Diet Quality Index (SDQI), based on intakes of saturated fat and dietary fibre, was a strong indicator of diet quality in the Danish population, and that the SDQI was successful in ranking the survey population according to diet quality, defined by the DDG 2005 and Nordic Nutrition Recommendations 2004 (NNR 2004)[11].

The population adherence to the five dietary recommendations has thus been studied previously, but it has never been investigated if the three new health messages included in the DDG 2005 are related to a healthy diet.

Thus the aim of the present study was to investigate the association between diet quality measured by the SDQI and

1. The behaviours related to the three new health messages in the DDG 2005: (i) food variety, (ii) BMI and (iii) leisure-time physical activity and total energy intake;
2. Social factors: (i) age, (ii) gender, (iii) education, (iv) household income (per person) and (v) location of residence;
3. The psychological dimension: intention to eat healthily.

Materials and methods

Study population

The Danish National Dietary Survey 2000–2002 is a cross-sectional survey comprising a random sample of 4120 individuals aged 4–75 years from the central population register. The present study includes 3151 adults aged 18–75 years. The response rate in this population group was 50 %[12].

Dietary intake was obtained using a 7 d pre-coded food diary with response categories for the most commonly eaten foods and dishes in the Danish diet supplemented with open-ended alternatives. The amounts of food consumed were given in household measures (cups, spoons, slices, etc.) or estimated from photos of different portion sizes showing four to six different portions.

Trained interviewers from the Danish National Institute of Social Research gave instructions on how to complete the food diary and how to estimate portion sizes. The interviewers also conducted in-person interviews in order to obtain information on variables such as social background, leisure-time physical activity, height, body weight and intentions to eat healthily.

The mean nutrient and food intakes were calculated for each individual using the General Intake Estimation System (GIES) version 0.995a (Danish Institute for Food and Veterinary Research, Søborg, Denmark) and the Danish Food Composition Databank version 5 (Danish Institute for Food and Veterinary Research; www.Foodcomp.dk).

Diet quality: compliers, intermediates and non-compliers

The SDQI was used to assess the overall quality of the diet. Each individual received a score for dietary fibre and a score for saturated fat, and the mean score of these estimates, the compliance score, was calculated. The score for each nutrient was determined by the ratio of nutrient intake relative to the intake recommended by the NNR 2004, and may attain values between 0 and 100. The calculation of the index is shown in the Appendix. The population was split into three groups: (i) compliers are the 25 % with the highest compliance score, i.e. they meet or are closest to meet the recommended intakes of saturated fat and dietary fibre; (ii) non-compliers are the 25 % with the lowest score, i.e. they are furthest away from the recommended intake; and (iii) the two middle quartiles were added together to form one group, termed the intermediates.

The subgroups were examined for differences in under-reporting. The degree of under-reporting was estimated for each individual by calculating recorded energy intake (EI) divided by BMR and estimating the proportions with EI:BMR$<1\cdot1$, which has been suggested by Goldberg *et al.* as an appropriate cut-off point for under-reporters[13].

Leisure-time physical activity

In the personal interview participants classified themselves into one of four different categories of leisure-time

physical activity (PA) during the last 12 months: (1) sedentary, i.e. mainly sedentary or <2 h of light PA weekly; (2) light, i.e. 2–4 h of light PA weekly; (3) moderate, i.e. >4 h of light PA weekly or 2–4 h of vigorous PA weekly; (4) vigorous, i.e. >4 h of vigorous PA weekly or regular hard exercise and participation in competitive sports several times per week[14].

Food variety

Food variety was based on 212 unique food groups, e.g. all white bread form one group, rye bread another, brown bread a third, and so on. Energy-dense, nutrient-poor beverages and foods, e.g. sugar-sweetened soft drinks and/or alcoholic beverages, confectionery, cakes, snacks and ice, were not included in the analysis of food variety. Food variety was calculated as the number of food groups consumed during the 7 d registration period. No minimum portion size was estimated.

Weight status

BMI was calculated from self-reported height and body weight and classified as[15]: (1) underweight, BMI < 18·5 kg/m^2; (2) normal weight, BMI = 18·5–24·9 kg/m^2; (3) overweight, BMI = 25·0–29·9 kg/m^2; (4) obese, BMI ≥ 30·0 kg/m^2.

Education

The variable was classified into seven groups based on a combination of school education and further education: (0) attending school; (1) basic school, <12 years in school; (2) upper secondary school, ≥12 years in school; (3) vocational education, 11–13 years' total education, mainly practical; (4) short higher education, 11–13 years' total education, mainly theoretical; (5) medium higher education, 15–16 years' total education; (6) long higher education, at least 17 years' education, of these 5 years' academic education.

Income

Income was based on household income before tax and afterwards adjusted for household size according to the general standard of the Organisation for Economic Cooperation and Development in order to calculate an income per person. The adjusted income was categorised into five equal-sized groups (<18 792 €, 18 793–28 188 €, 28 189–37 584 €, 37 585–46 980 €, >46 981 €).

Location of residence

Location of residence was classified as capital, capital suburban area, capital other, non-capital cities with ≥100 000 inhabitants, cities with 10 000–99 999 inhabitants, or other.

Intentions to eat healthily

Intentions to eat healthily were measured by asking to what extent the participants intended to eat healthily. The four response categories were: very often, often, once in a while, never. This question was implemented in the Danish National Dietary Survey in order to investigate the association between behavioural intentions and actual behaviour inspired by the Theory of Planned Behaviour[16].

Health focus and perceived healthy foods

Two variables were included in the description of compliers, intermediates and non-compliers in order to indicate health focus, food values and knowledge about healthy foods: (i) factors the respondents attach importance to when planning dinner; and (ii) perceived healthy foods.

Statistical analyses

Basic statistical characterisation of compliers, intermediates and non-compliers was performed for men and women separately, using simple χ^2 tests and ANOVA. Proportional odds logistic regression models were used to explore the independent effect of energy intake, leisure-time physical activity, food variety, BMI, age, gender, education, household income, location of residence and intention to eat healthily on the likelihood to be a complier.

Age and energy intake were included as continuous variables in the logistic regression model.

The analysis was stratified in the following three population groups:

1. Men (18–75 years), except young male students (≤30 years; n 1354).
2. Women (18–75 years), except young female students (≤30 years; n 1508).
3. Students, ≤30 years old (n 221).

Students were defined as educational group '(0) attending school' and group '(2) upper secondary school', and consisted of young persons (≤30 years) who were in the process of taking an education. In this population, no differences between the two genders were found when controlling for energy intake and intentions to eat healthily, and therefore they were stratified into a separate group (population group 3).

Factors the respondents attach importance to when planning dinner and perceived healthy foods were not included in the logistic regression model, because responses were given as non-prioritised multiple answers. Instead, the distribution of answers was calculated as simple answer percentages within the groups and the rank of answers between groups was tested using a Spearman rank-order correlation.

Statistical analyses were carried out using the SAS/STAT statistical software package version 9·1 (SAS Institute Inc., Cary, NC, USA).

Results

The total diet quality score varied between 11 and 100. Women had a higher diet quality score than men (median (25th, 75th percentile): 65 (52, 80) v. 54 (42, 69); data not shown).

Compared with intermediates and non-compliers, the diet of compliers was closer to current dietary guidelines and contained significantly more wholegrain cereals, fruits, vegetables, fish and drinking water and more frequently low-fat dairy products, lean meats and boiled potatoes. Furthermore, the diet of compliers contained less confectionery, sugar-sweetened and alcoholic beverages than the diets of intermediates and non-compliers.

Characteristics of compliers and non-compliers (unadjusted)

Table 1 presents the unadjusted characteristics of the three subgroups. Compared with intermediates and non-compliers, compliers were likely to be older, women, report a lower or under-report energy intake, eat a more varied diet, have a higher education, have a higher intention to eat healthily, be more physically active during leisure time and live in the capital area. Non-compliers were likely to be younger, men, report a higher energy intake, be less physically active during leisure time, have a lower intention to eat healthily, eat a less varied diet and live outside the capital area.

OR for being a complier

The results from the logistic regression analysis are given as odds ratios for the different factors associated with compliance, see Table 2 (men) and Table 3 (women). Lower energy intake, higher physical activity level during leisure time, frequent intentions to eat healthily and greater food variety (the number of different food groups consumed) were significantly associated with being a complier, i.e. having a higher diet quality. For women, education and BMI were also associated with diet quality. For women, men and students no associations were found between diet quality, income and location of residence; therefore these variables were omitted from the final logistic regression model.

An increase in energy intake of 1000 kJ reduced the odds of being a complier for men (OR = 0·88) and women (OR = 0·78). Higher physical activity level during leisure time was associated with higher diet quality. Especially the most physically active groups deviated from the more sedentary groups. The most active men and women during leisure time were about twice as likely to be compliers compared with sedentary individuals (OR = 1·91 for men, 2·20 for women).

Concerning food variety, the total range ran from eleven to ninety-five food groups. An increase of five food groups increased the odds of being a complier (OR = 1·13 for men, 1·32 for women).

Men and women who 'very often' intended to eat healthily were respectively five and eight times more likely to be compliers compared with those never having intention to eat healthily. There was a systematic trend for a healthier diet with more frequent intentions to eat healthily. The odds increased with a factor of almost 2

from the response 'once in a while' to 'often' and to 'very often' for both men (Table 2) and women (Table 3).

Among women, higher educational level (short, medium or long higher education) was associated with higher diet quality compared with those having lower educational level (basic school or vocational education). No association between education and diet quality was found among men.

Weight status was also associated to diet quality. Underweight women were less likely to be compliers than normal weight women, and obese women were more likely to be compliers than normal-weight women.

For students (population group 3) approximately the same associations were found as for men (results not shown), but the odds ratio for intentions to eat healthily was twice as high in this group (OR = 11·66) than in population group 1 (men).

Health focus and perceived healthy foods

As shown in Fig. 1, compliers attached more importance to health whereas non-compliers attached more importance to taste and family preferences when planning dinner. The gender-specific response showed that the factors the female respondents regarded as important when planning dinner were ranked significantly differently ($P < 0·001$) between compliers, intermediates and non-compliers. For men, the answers differed only between compliers and non-compliers. Compliers most often attached importance to low in fat (1), many vegetables (2; women), taste (2; men) and home cooked (3). Non-compliers most often attached importance to family likes the food (1; women), taste (1; men) and home cooked (2). Compliers, intermediates as well as non-compliers perceived healthy foods as many vegetables and low in fat – in that order.

Discussion

In the present study frequent intentions to eat healthily had the strongest association with healthy dietary habits. Furthermore, high physical activity level during leisure time, lower energy intake and higher food variety were associated with higher diet quality measured by the SDQI. The present study also indicated that higher educational level was associated with a higher SDQI score for women. However, it should be noted that the participants in the Danish National Dietary Survey 2000–2002 were more educated and had a little higher mean personal income than the population in general.

Previous studies have shown that higher diet quality is related to healthy behaviours such as being physically active during leisure time and eating a varied diet[6,17–21]. In line with the findings in the present study, other studies have also shown that those with higher diet quality were more likely to be women and older[19,22].

Table 1 Characteristics (unadjusted) of compliers, intermediates and non-compliers with dietary goals: random sample of 3151 Danish adults aged 18–75 years from the Danish National Dietary Survey 2000–2002

Characteristic	Compliers (n 787) Mean or %	SD	Intermediates (n 1577) Mean or %	SD	Non-compliers (n 787) Mean or %	SD
Women (%)	68[a]		55[b]		37[c]	
Men (%)	32[c]		45[b]		63[a]	
Age (years)	46[a]	15	43[b]	15	44[b]	15
Men	47[a]	15	44[b]	15	45[a,b]	15
Women	46[a]	15	42[b]	15	42[b]	15
Energy (MJ)	8·2[c]	2·6	9·2[b]	2·6	10·1[a]	3·0
Men	9·5[c]	3·1	10·3[b]	2·6	11·0[a]	2·9
Women	7·6[c]	2·0	8·3[b]	2·1	8·6[a]	2·4
SDQI score	87[a]	8·0	60[b]	8·0	36[c]	7·5
Men	86[a]	8·3	60[b]	8·0	36[c]	7·6
Women	88[a]	7·8	61[b]	8·0	37[c]	7·0
EI:BMR<1·1 (%)*	33[a]		22[b]		19[b]	
Men	35[a]		25[b]		19[c]	
Women	31[a]		20[b]		20[b]	
BMI (kg/m²)†	24·8	4·0	24·7	3·9	24·8	4·0
Men	25·7	3·7	25·4	3·4	25·5	3·5
Women	24·3	4·1	24·1	4·3	23·6	4·4
Weight status (%)						
Overweight† (total)	29		30		32	
Men	39		39		39	
Women	23		22		18	
Obese† (total)	10		10		10	
Men	13		10		11	
Women	9		11		10	
Education: short, medium and long higher education (%)	34[a]		29[b]		23[c]	
Men	32		30		25	
Women	35[a]		27[b]		19[c]	
Moderate/vigorous leisure-time physical activity (%)‡	55[a]		47[b]		42[b]	
Men	60[a]		56[a]		47[b]	
Women	52[a]		40[b]		34[b]	
Food variety§	40[a]	9·0	39[b]	9·7	36[c]	8·3
Men	38	8·5	38	8·5	36	8·2
Women	41[a]	9·0	40[b]	8·7	36[c]	8·4
Intention to eat healthily 'very often' and 'often' (%)	91[a]		73[b]		48[c]	
Men	83[a]		64[b]		42[c]	
Women	94[a]		80[b]		57[c]	
Living in capital area (%)	35[a]		33[a]		28[b]	
Men	34		32		27	
Women	36		34		31	
Income per person (€)‖	34 939[a]	16 640	33 849[a,b]	15 529	32 988[b]	14 956
Men	35 961	16 028	35 897	15 847	34 816	15 339
Women	34 421[a]	16 936	31 987[b]	15 002	29 623[c]	13 626

SDQI, Simple Diet Quality Index; EI, energy intake.
[a,b,c]Values within a row with unlike superscript letters were significantly different ($P < 0.05$).
*With 7 d dietary measurements, EI:BMR < 1·1 indicates under-reporting at the individual level[13].
†BMI and prevalence of overweight and obesity estimated from self-reported weight (kg) and height (m).
‡In the personal interview participants classified themselves into one of four different levels of leisure-time physical activity (PA) during the last 12 months: (1) sedentary, i.e. mainly sedentary or <2 h of light PA weekly; (2) light, i.e. 2–4 h of light PA weekly; (3) moderate, i.e. >4 h of light PA weekly or 2–4 h of vigorous PA weekly; (4) vigorous, i.e. >4 h of vigorous PA weekly or regular hard exercise and participation in competitive sports several times per week[14].
§Eating a number of different food groups.
‖1 € = 7·46 DKK (Danish Kroner).

Several studies, both cross-sectional and cohort, have found an association between higher diet quality and lower BMI[19,20,23]. Therefore it was expected that the compliers group would have a lower mean BMI. However, compliers did not differ in weight status from non-compliers even if they ate a healthier diet, reported a lower energy intake and had a higher physical activity level during leisure time than non-compliers. This may be explained by a higher prevalence of under-reporting among compliers compared with non-compliers. In the present study, obese women (BMI ≥ 30 kg/m²) were more likely to be compliers than normal-weight women (Table 3). Several studies have found an association between high BMI and under-reporting[24–27] and this may also be the case in the present study. The EI:BMR ratio was very low (1·28) in the compliers group compared with a plausible measure of at least 1·53 for a similar group size[13]. This indicates that compliers under-reported their energy intake and 33 % of compliers were estimated as under-reporters (Table 1). Under-reporting

Table 2 Odds for men (*n* 1354; excluding male students aged ≤30 years) of being a complier with dietary goals: random sample of Danish adults aged 18–75 years from the Danish National Dietary Survey 2000–2002

Dimension	OR	95 % CI	P
Energy, per increase of 1000 kJ	0·88	0·85, 0·92	<0·001
Leisure-time physical activity			
2 *v.* 1*	0·99	0·68, 1·46	0·977
3 *v.* 1	1·22	0·83, 1·79	0·311
4 *v.* 1	1·91	1·20, 3·02	0·006
Food variety, per 5 extra food groups consumed	1·13	1·05, 1·21	0·001
(food variety range: 15–72 food groups)			
Intention to eat healthily			
1 *v.* 4†	5·40	3·75, 7·78	<0·001
2 *v.* 4	3·00	2·14, 4·21	<0·001
3 *v.* 4	1·69	1·19, 2·40	0·003
Educational category			
4 + 5 + 6 *v.* 1 + 3‡	1·01	0·80, 1·27	0·959
Weight status§			
1 *v.* 2	0·78	0·17, 3·69	0·758
3 *v.* 2	1·05	0·84, 1·31	0·691
4 *v.* 2	1·17	0·83, 1·66	0·376

*Levels of leisure-time activity are described in Table 1.
†1 = Very often, 2 = Often, 3 = Once in a while, 4 = Never.
‡1 = Basic school, 3 = Vocational education, 4 = Short higher education, 5 = Medium higher education, 6 = Long higher education. Groups 0 and 2 consist of students aged ≤30 years; these groups are not included in the present analysis.
§1 = Underweight, 2 = Normal weight, 3 = Overweight, 4 = Obese.

Table 3 Odds for women (*n* 1508; excluding female students aged ≤30 years) of being a complier with dietary goals: random sample of Danish adults aged 18–75 years from the Danish National Dietary Survey 2000–2002

Dimension	OR	95 % CI	P
Energy, per increase of 1000 kJ	0·78	0·74, 0·82	<0·001
Leisure-time physical activity			
2 *v.* 1*	1·15	0·80, 1·67	0·448
3 *v.* 1	1·56	1·07, 2·28	0·022
4 *v.* 1	2·20	1·28, 3·80	0·005
Food variety, per 5 extra food groups consumed	1·32	1·23, 1·41	<0·001
(food variety range: 11–95 food groups)			
Intention to eat healthily			
1 *v.* 4†	8·19	4·70, 14·28	<0·001
2 *v.* 4	3·77	2·18, 6·48	<0·001
3 *v.* 4	1·32	0·74, 2·35	0·351
Educational category			
4 + 5 + 6 *v.* 1 + 3‡	1·46	1·16, 1·83	0·001
Weight status§			
1 *v.* 2	0·42	0·24, 0·73	0·002
3 *v.* 2	1·27	0·99, 1·63	0·058
4 *v.* 2	1·55	1·11, 2·18	0·011

*Levels of leisure-time activity are described in Table 1.
†1 = Very often, 2 = Often, 3 = Once in a while, 4 = Never.
‡1 = Basic school, 3 = Vocational education, 4 = Short higher education, 5 = Medium higher education, 6 = Long higher education. Groups 0 and 2 consist of students aged ≤30 years; these groups are not included in the present analysis.
§1 = Underweight, 2 = Normal weight, 3 = Overweight, 4 = Obese.

may also distort reporting of unhealthy foods and may be associated with the intention to eat a healthy diet[26,28]. Together, it is possible that the high intentions to eat healthily and under-reporting of compliers may have created an overestimation or a false association between dietary compliers and the variables included in the regression models. This may disguise the association between BMI and the SDQI. This is a clear limitation in the present study, where the aim was to measure the participants' usual diet. However, excluding under-reporters from the analysis did not change the overall results.

Compliers had lower energy intake and higher food variety than non-compliers. In a German study total energy intake and food variety were positively associated with diet quality[4]. In that study food variety was measured by simply counting the number of food items actually consumed, including nutrient-poor, energy-dense foods such as confectionery; diet quality was expressed in absolute terms and not as relative intakes of nutrients, with the result that a higher energy intake automatically will be followed by a higher intake of nutrients. In the present study, diet quality was calculated in relative terms and unique food subgroups were used in
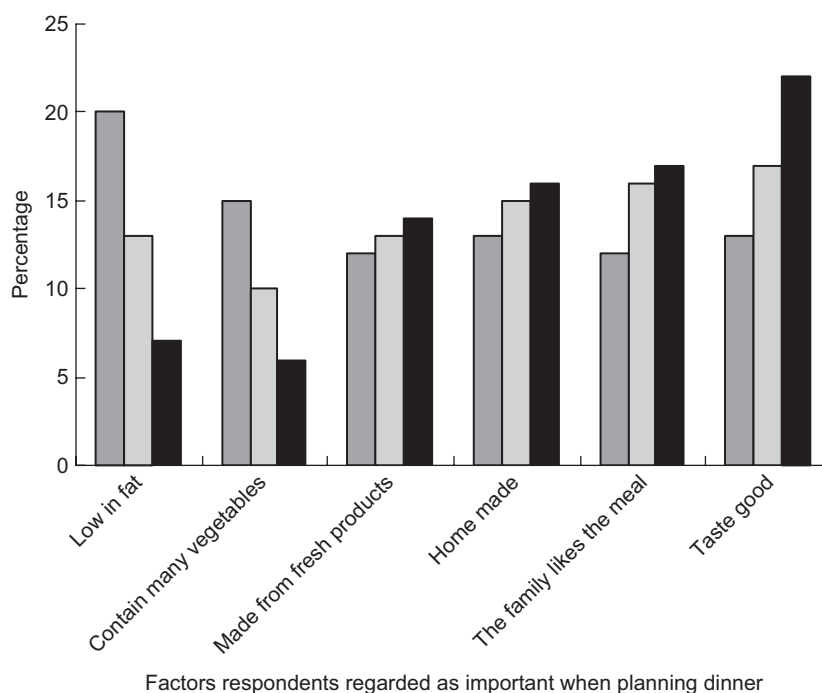
Fig. 1 Answers* (percentage) of compliers (▨), intermediates (▢) and non-compliers (■) with dietary goals to the question 'What do you attach importance to when you decide dinner meals?': random sample of 3151 Danish adults aged 18–75 years from the Danish National Dietary Survey 2000–2002. *Eighty-five per cent of the population gave three un-prioritised answers; 15 % gave fewer than three answers

order to avoid the situation that two kinds of white bread would count twice, as regards food variety. Furthermore, nutrient-poor, energy-dense foods were not included in the analysis. The food variety variable has the disadvantage that it does not include a minimum daily serving, i.e. an insignificant small food intake from a food group could result in higher food variety.

In the present study the variable showing the strongest association with the SDQI was the intention to eat healthily, suggesting that personal intentions are very important for healthy dietary habits. The predictive importance of behavioural intentions has been demonstrated in many studies. The underlying theoretical model for this concept is the Theory of Planned Behaviour proposed by Ajzen in 1985[16]. In a Norwegian/Dutch study it was found that individuals who planned one healthy eating day a week were eating healthier during a 5 d period than people who did not plan such a day. Planning one healthy eating day was beneficial both for those with healthy and those with unhealthy eating habits[29]. In another Dutch study, specific plans to eat an extra serving of fruit increased the likelihood for that person to eat more fruit[30]. It has been suggested that planned intentions may be a part of habit formation[31]. A Norwegian study found that intention was predictive for total fat intake of men eight years later[32] and an English study found that planned intentions to reduce fat intake significantly reduced the intake of total fat, saturated fat and the proportion of energy derived from fat, after

1 month[33]. A newer study by Ogden et al. suggests that behavioural intentions is not a unidimensional construct and positive and negative versions of this variable have differential effects[34]. In the present study behavioural intentions were treated as a unidimensional construct, which might have covered a possible differential impact from either positive or negative intentions.

In the present study, compliers had frequent intentions to eat healthily. The EI:BMR of compliers was low, which indicates that the recorded food intake hardly reflected their usual diet and suggests that the high level of intentions, registered in the in-person interview, most likely influenced their food consumption in the registration period.

Compliers differed from non-compliers as their food/meal focus was health-oriented, i.e. 'low in fat' and 'lots of vegetables', whereas non-compliers were more focused on the fact that the food 'tastes good' and 'the family likes the meal'. The groups did not differ in their perception of healthy foods. Thus, non-compliers had knowledge, at the general level, to include healthy foods in their diet, but they prioritised taste/pleasure. Thus, it will be a challenge to reach the non-compliers through a set of dietary guidelines where taste and pleasure is not on the agenda and it is not likely that non-compliers will be motivated to a change in lifestyle by the new health messages in the DDG 2005. Other initiatives might be necessary to reach non-compliers. Since both compliers and non-compliers prioritised 'home cooked' meals, a

way to reach non-compliers could be through home economics in schools, illustrating that pleasure and healthiness do not have to be in conflict. Positive school experiences with making healthy and tasteful meals might contribute to the formation of healthy eating habits[30,35]. A Danish study suggests that interest and intentions to prepare healthy and tasty meals evolve from positive experiences in childhood with cooking either at home or in school[36]. An American study found that young adults who reported frequent food preparation were more likely to meet dietary objectives for fat, Ca, fruit and vegetable and whole grains consumption than those with low food-preparation behaviours[37]. Seen in this light, it is of concern that only 5% of families in Denmark involve their children in cooking (Danish National Dietary Survey 2000–2002, unpublished results). The majority of these families ($P < 0.001$) are found in the group of compliers.

In conclusion, the results of the present study suggest that the behaviours related to the new health messages in the DDG 2005, i.e. 'Eat a varied diet' and 'Engage in regular physical activity', are associated with healthy eating. The present study was unable to demonstrate that lower BMI was associated with higher diet quality measured by the SDQI. Healthier dietary habits are strongly influenced by personal intentions, and it is a future challenge to reach the non-compliers, who seldom have intentions to eat healthily and feel well without doing so, even though they know which healthy foods to include in their diet.

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Appendix

Example of calculation of the Simple Diet Quality Index

Calculation of the dietary fibre score

Recommended dietary intake (NNR, 2004): 3 g/MJ
Intake of dietary fibre for an individual: 2 g/MJ
Thus

$$\text{Score} = (2/3) \times 100 = 67$$

(When intake $\geq$3 g/MJ, score = 100)

Calculation of the saturated fat score

Recommended dietary intake (NNR, 2004): $\leq$10 %E (without alcohol; where %E is percentage of energy)
Intake of saturated fat for the individual: 13 %E
Thus

$$\text{Score} = \{1 - [(13 - 10)/10]\} \times 100 = 70$$

(When intake $\leq$10 %E, score = 100; when >20 %E, score = 0)

Calculation of SDQI

The SDQI is the average of the dietary fibre score and the saturated fat score. Thus, for this particular individual

$$\text{SDQI} = (67 + 70)/2 = 68{\cdot}5$$